US ARMY CORPS OF ENGINEERS

Moderator: Julie Marcy
July 31, 2013

Julie Marcy: And now I'll give you today's speaker on dredge material evaluation and testing, Dr. Jeff Steevens. Jeff is a senior research scientist and toxicologist at the ERDC Environmental Lab. He has co-authored over 50 publications on a variety of contaminants including dioxins, metals, polycyclic, aromatic hydrocarbons and pesticides. He's been instrumental in improving sediment toxicology and bioaccumulation methods and interpretation as part of many high profile Corps dredging projects.

These include The New York Harbor, Portland Harbor, Houston Ship Channel and the New Orleans Industrial Canal. Jeff is currently a co-author on the revision of the Corps EPA Joint Dredge Material Evaluation and Management Guidance manual. And you can see much more information about Jeff's distinguished background in the bio posted on the DOTS page along with a copy of the PowerPoint he'll be sharing today.

Jeff, we're very happy to have you with us. And I'm going to assign you presenter rights. And you should have that now. Take it away.

Dr. Jeff Steevens: Fabulous. Thank you. So as Julie just mentioned my background is in Ecotoxicology and I've been involved in several dredging projects across the US and involved with some of the folks that are on the phone today. And I'll be drawing on some of those experiences as I provide an overview of the dredge material testing an evaluation process that the Corps has jointly developed with the EPA.

Just to caveat this; this presentation just provides an overview. It's an adaptation of a presentation that I've used previously in public meetings to describe the Corps' dredge material evaluation process. Because of the diversity we have on this webinar we'll have to limit some of the details that we get into. But we can feel free to dwell into some of the details later on once I finish the presentation.

So this is the outline of the presentation that I'll give today. And I want to just kind of go through a little bit of the background for the evaluations and provide some information about the dredge material evaluation guidance documents that are currently available. And then discuss the tiered process. And this is where we'll get into the details of the presentation here and actually some of the guidance documents.

Then lastly I want to touch just briefly on the existing regional guidance documents which are currently available. And there are quite a few of those available. So if you've been following the DOTS webinar series, we've had 2 pretty good presentations so far. The first one was by Joe Wilson on the legal aspects of dredge material evaluations. Then the second on an overview of dredge material processes and a little bit about the Corps's dredging program.

And so that's a really good background if you've had a chance to catch those webinars. If not, they're still available on the DOTS website. But back in June, Mr. Verna gave a nice presentation describing the amount of dredge material that the Corps permits each year; around 240 million cubic yards this last fiscal year. Of that material, the sediments are either placed in water which is our cheaper alternative or manage into a placement such as an upland facility, or if it's contaminated, maybe a confined disposal facility.

Earlier in May, Joe Wilson described some of the legal aspects of the requirements to evaluate the environmental effects of contaminants. And that's required mainly by 2 laws, the Clean Water Act and MPRSA which is the Marine Protection Research and Sanctuaries Act.

Dr. Jeff Steevens: The guidance documents that I'll be discussing are listed here. There's several guidance – National guidance documents which essentially provide a process for the technical evaluation to comply with the relevant statutes and regulations that are provided for dredge material. And some examples of some of these guidance documents are shown here on the left.

The first one is the technical framework which essentially guides the user through the scoping of the dredging action in evaluating some of the alternatives. The two we'll discuss today are the documents to determine the suitability for open water placement. And those are the Inland Testing Manual and the Ocean Testing Manual. There are some other documents listed here. And I'm hoping that (Cynthia) and Julie will push to have a webinar in the future, one on the Upland Testing Manual and another one on the beneficial use of dredge material as well. I'd like to highlight that these guidance documents are available on the DOTS website where you can download them and read them at your leisure. So the first document I'd like to discuss is the Inland Testing Manual which addresses the regulations for the Clean Water Act. The main goal of this document is essentially to determine whether or not a dredge material placement in water will cause an adverse – an unacceptable adverse impact.

This first guidance document was established shortly after the Clean Water Act was passed in 1972. They had a few years to develop the procedures and the technical evaluation. That interim guidance was established in 1976. I'd like to highlight 2 important points here with respect to this interim guidance. Back in 1976, they established what we call our effects-based test. And this is the use of bioassays to determine whether or not a sediment has toxic properties. That is is it toxic or not.

We continue to use this approach and it remains essentially one of the best approaches we have to evaluate the potential effects of contaminants and their toxicity. The second component of that interim guidance was what we call – at the time we called it a sequenced approach. Back in 1998, they had a revelation. They changed that to a tiered approach. I believe in the new version we'll call it levels.

The next guidance document that we'll talk about is the Ocean Testing Manual. This guidance document was developed to address the MPRSA often called the Green Book and that's because it has a green cover. It address the requirements that dredge material when placed in the ocean will not endanger or degrade the various components of the ecosystem including human health, welfare, the environment and the economic potentialities.

The first version was developed shortly after the Inland Testing Manual was developed. It reflected the science for the most part that was developed that interim IPM guidance. It includes the effects-based testing approach and also includes the sequenced and the tiered approach. One unique aspect that was brought into this guidance document that is the ocean testing manual was the use of bioassays and approaches to evaluate bioaccumulation.

And the reason for that is that it's specifically stated in the regulations that that had to be considered. So the next slide here shows the risk assessment and management process. I'm bringing this up because although we continue to use the 1991 OTM and the 1988 IPM we've essentially moved a lot of our science forward to the point where we're using more of a risk-based approach. When I say that, we're using this in 2 main components, the first which is highlighted in the blue.

Dr. Jeff Steevens: We have the problem formulation analysis and then the characterization. And that's all used to really inform how we can best manage the sediments. And some of you have heard about the new revision of the guidance documents into a combined manual. And essentially this new document will be capturing this entire risk assessment and management process. So the current guidance documents focus primarily on this blue section.

And it's essentially the problem formulation which is identifying what is the proposed action? What chemicals are present? Is there a potential for those chemicals to cause an effect? Than once we complete that component, we move into an analysis phase which is to determine are contaminants present in that sediment? At what concentration are they present? Are they available to organisms such that an exposure can occur? And then the second part of that is on the effects side is are they present at levels which are toxic?

Once we collect that information which is part of this tiered approach is to then characterize or quantify what those potential risks are. And so the process we use currently is to compare our dredge material to what we call a reference site or a relatively uncontaminated site that might reflect similar sediments to what the dredge material or the placement site. And that information then is used to help manage the sediment.

So on the next slide, I'm showing another part of what we call a risk assessment process. This is essentially a generic conceptual model that's used to frame a problem. And this is used very commonly in risk assessment. Often in practice we hesitate to use diagrams like this because we feel that they're intimidating or maybe not essential. But a conceptual model is very useful; they're fairly simple. In this case we have box and stick diagram.

Sometimes you see people use depends up their budget. Sometimes they'll use cartoons or pictures. And it's essentially to help the planner identify the questions that need to be asked with respect to the source material. That is the dredge material in this case, the potential pathways in which contaminants may reach the environment. And then to identify what are the relevant receptors. And this really helps guide the entire process.

And while currently we often do not use a conceptual model to, such as this, to help guide our evaluation, often times we're doing it in our head and we don't document it very well. The pathways that we consider are the water born pathway which is the water column component. And then the direct contact which is the sediment once it is placed at the site where we're going to be placing the material, the disposal site. I hate to call it disposal site. It's a placing site.

And then organisms that might be exposed during those management options. So a benefit of using a conceptual model is to be sure that you identify relevant organisms as part of your testing and evaluation. For example, I've run into different situations where people have used organisms in their bioassays which aren't present at their disposal site. And so that's an opportunity where maybe busing a conceptual model might help rule out some of the silly things we might end up doing.

Okay on this next slide I'm showing the tiered approach that we use. And this is a fairly old figure that we've used in the past for some of our dredge material management training to describe this tiered approach which is outlined in the OTM and the ITM. And the – the process that we use for dredge material evaluations has 4 tiers. And on the sides of this triangle, you can see some arrows.

And we start at the top which is tier 1 going to tier 4. And as we move through the tiers, we benefit by having enhanced resolution with respect to the evaluation. So we're gaining more data, getting a better idea about what's the potential for these contaminants to cause risk. On the other side we also have to recognize that with these additional tests it also increases the complexity of the analysis. And it also increases the cost.

And so while there are some advantages to having more data, there's also some associated drawbacks. It's more complicated to evaluate. And sometimes the expense can get to be fairly significant. So the tiers that we'll discuss today are the tier 1 which is the use of existing data. Tier 2 which is to use straining methodologies. Tier 3 which is to use what we call the effect-based approaches, the toxicity bioassays and then also bioaccumulation bioassays to evaluate the movement of contaminants in the food web.

The last tier shown here is essentially - there are different terms we use for this. But it's essentially when the first 3 tiers don't provide answers that are – that we consider adequate and so additional specific studies have to be conducted to better understand the potential risk of the contaminants in the dredge material. So the next few slides I'll start moving into this tiered process. And the first tier is where we use existing information to determine if there is a potential for an adverse impact or if there's a potential for a contaminant to cause that adverse impact on the environment.

It relies primarily on historical data regarding contamination such as what are the potential pathways of contaminant sources, potential spill information. Is it an area where we have historical information that contaminants are present? The other part of that are the physical characteristics of the site. And that includes things such as bathymetry, currents, deposition, and the time since the last dredging was required or conducted. So you may have prior data that might help support an evaluation.

One of the important components of the tier 1 assessment is to identify well what are some of the potential contaminants of concern? An important piece of this is to keep in mind at what concentration will it affect the curve. And so at this point we're trying to identify what chemicals may be present in the sediment. And at what levels might they cause an adverse effect. If you're checking your emails the same time as listening to the webinar, so pay attention to this.

One key point is don't analyze everything. A lot of times, the chemists will complain about this. When you hand them a sediment and you tell them, "analyze for chemicals in the sediment." Don' task for that. Only focus on the chemicals which are relevant. Well how do we determine that? There are 3 important factors. And there are actually some more. But these are kind of the big main 3. And the first one is what are the chemical properties of the contaminant of concern?

Things such as what's the potential mobility of these contaminants? Can they move into your dredge material? Are they bioavailable to organisms that may be present in the sediment? And how persistent are they? I have an example of persistence here. Here we have 2 simple chlorinated ring structures, dichlorobenzene and hexachlorobenzene. Dichlorobenzene for example has a half-life of 10 days. Hexachlorobenzene has a half-life of 6 years.

So if you were to consider one of these chlorobenzenes as a contaminant of concern, you wouldn't really worry too much about dichlorobenzene because it wouldn't last very long in your sediment. However, Hexachlorobenzene we know can stick around for quite some time. The second factor is the toxicological significance. And one of my favorite examples that I like to use is from the movie, Erin Brockovich, hexavalent chrome versus chrome 3.

Chrome 3 is really – is relatively nontoxic whereas Chrome 6 we know is apparently potent causing Leukemia. So when we're thinking about what kinds of chemicals, we also want to focus our attention on the ones that are relatively toxic. And then the third important factor is the potential for these chemicals to bioaccumulate and move through the food change. Some examples there are the PTBs, the DBTs are the chemicals that are known to move into the food web.

So with respect to tier 1, one of the other important aspects is the opportunity to rule out the need for further evaluation. And we do this so that we can look at those contaminants and essentially based on existing information determine that the sediments and the contaminants associated with the sediments are unlikely to degrade the environment. And I'm not going to get into the details of the exclusions because we could actually talk about those for a whole hour.

But we can put them into 2 main categories. One is that the sediments are unlikely to contain contaminants. That is imagine if you have dredge – potential dredge material that's sand, gravel or rock or is in a high energy environment. It's very unlikely that there will be contaminants associated with that material. Also if there's no evidence of contamination and it's far removed from sources of potential contaminants.

However if there are contaminants, there are still opportunities for the material to be excluded. Just because there's chemicals present doesn't mean it's going to cause an adverse effect. And we can use evidence or data from previous evaluations that have been able to show that there is not an adverse effect or that it's unlikely. The other 2 opportunities are mainly through the Clean Water Act in which case if the placement is nearby.

So imagine if your side casting as part of your dredging project and you're putting words we like to use are like on like, that there's an opportunity for an exclusion and then also if the contaminants can be managed. So if you can place these materials if they are contaminated and even if they have the potential to cause adverse effect, we can manage those such as a confined aquatic disposal and cap the materials. We can reduce the potential for adverse effects.

Okay. So to move beyond tier 1, then a determination has been made that there are contaminants in the sediment and that there is a potential for adverse effects. And as you recall, the conceptual model I showed earlier this is essentially a picture to help describe these pathways. And again this is important so again if you're checking your emails, I want to highlight again 3 main points. As we're looking at this picture, you can see here we have the dredging operation.

And what we're really interested in is the – the potential effects associated with the placement at the aquatic site. And so the first potential pathway for exposure is in the water column. And this is during the placement when the sediment you can imagine falling through the water column. And then some of the contaminants may be released during that process in which case this poor little fish here may be exposed for a short duration to those contaminants.

And so for the water column evaluation, our testing or evaluation is relatively short. Than the second component is the placement at the bottom. So image if the sediment moves or the dredge material moves to the bottom, there's the long term exposure of organisms that are present in the sediment or that might colonize that dredge material. What is their potential for adverse effects? Than the third piece which is shown over here by the fish eating the fish eating the fish and then the fisherman up here is the potential for organisms to colonize this dredge material, be exposed to contaminants and then move through those contaminants to move through the food web to other organisms such as fish, birds, wildlife and humans.

So the purpose of the evaluation is to examine these 3 main pathways. So now we'll switch gears a little bit and talk about those 3 main pathways. And to do that, we'll discuss first the tier 2 which is the screening procedures and then the tier 3 which is the bioassay. So for the water column effect, we have some different predicted models or approaches to determine the potential 4 effects. And we use our sediment and elutriate chemistry. And I'll talk about that in just a second to determine compliance with relevant water quality criteria and standards. And there's 2 steps to this. The first step is a screen step where we use the chemical analysis of the – of the sediment. And we assume that all of the contaminants of concern measured in that sediment are released to the water column.

And that is then compared to the water quality criteria and standards. The second part to that is if we still exceed that analysis, we go to the chemical analysis of what we call the elutriate. And I have a little picture shown over here with a little flask. And we make an elutriate to represent that slurry that might form or that plume that might form during the placement of the dredge material at the placement site. And so we use 4 parts of water and 1 part dredge material. And we mix that up allow it to settle for a short period of time.

And then we analyze that liquid phase to estimate. And it's a very conservative estimate of the potential chemical releases to the water column. Than that information is used to compare to – or we use that as part of the mixing models to determine if the levels exceed the state or the federal water quality standards and criteria. This figure shows the dredge material down here at the bottom, right there, the mixing zone where the dredge material is placed and an area outside the mixing zone.

And within the mixing zone the law allows for a period of mixing. And that's 4 hours within a mixing zone. That mixing zone is defined by the states and then it must meet the criteria after that period of mixing. Outside the mixing zone, the criteria must be met at all times. And so we use that elutriate data to determine our compliance within these various – within the mixing zone and outside the mixing zone.

Julie Marcy: Jeff, this is Julie. We had one question. Can you define the acronym MPRSA for us please?

Dr. Jeff Steevens: Yes. That is the Marine Protection Research and Sanctuaries Act.

The second part of the water column evaluation, which is Tier 3, is if you exceed or - in the screening step, if there's the potential for affects based on the comparison to the water quality criteria or the standards, we can move to this phase, particularly if there are no applicable criteria for your containment of concern.

Or if there are mixtures, then we do a bioassay. And we prepare the elutriate the same way as we did before, except this time we take that liquid phase and we dilute that in a serial dilution, say 150 10% in the dilution water and we expose these poor little guys. There's different water column organisms that we'll use. These are just - this is a (mysid) on top. And often we use a larval stage of a minnow to evaluate what's the potential toxicity of these elutriates. And we try to determine this dose-response curve, which is - on the bottom we have a concentration and on the Y-axis we have an effect. In this case it's mortality. And so we try to identify what we call the LC50. And that's the concentration of the elutriate which results in 50% mortality of the organisms.

Now how do we use this information? So we determine it's LC50 if we can, and then we apply what's called an application factor. And this is essentially a conservative factor to determine a concentration at which an effect is unlikely to occur. So essentially in toxicology we call that a NOEC - a no observed effect concentration. So at what concentration do we not expect any effects to occur?

Then we use that as part of some of our dilution models to determine whether or not this potential for an effect would be observed within that mixing zone and whether or not it exceeds that four hour period. And do we exceed this level of effect outside the mixing zone?

So that's just kind of a very brief overview of the elutriate bioassays. The second thing I want to get into is the sediment toxicity component. In - within Tier 2 we really don't have good mechanisms for screening for the potential for toxicity of containments and sediments.

Now a lot of you may say, "well there's the sediment quality guideline values." And if you go to NOAA's Web site they've got a screen quick reference table for all these sediment guideline values that we can use. And I want to point out that these really should not be used to make decisions. And there's - I list three different reasons why, and I'll go through these real quick. But the sediment quality guideline values - there's different types of them. But for the most part they're generated in one region of the country.

So say a sediment quality guideline value might have been developed for the Gulf of Mexico. And then folks may want to try to apply it up in the State of Washington or up in New York. And we need to be very careful about the use of those different guideline values because the sediments are different, the geochemistry is different, the bioavailability may be different. And so use of the sediment quality guideline values - we need to do that very carefully.

The other thing is most of the sediment quality guideline values do not address mixtures of contaminants. They might address classes of contaminants but not really mixtures. So maybe within polyaromatic hydrocarbons, or those associated with oil, we can lump those. But if you have say PAHs - like the oil - and metals, the sediment quality guideline values cannot handle that.

And then the third one which is a bit more disturbing than the previous two, is that there's a high rate of false positives and negatives. And so the use of sediment quality guideline values - you need to be very careful about that too.

So why do I even bring these up? Well we can use sediment quality guideline values to determine whether or not a material is unlikely to cause an affect. And so say you have a sediment quality guideline value and you find that the concentration of contaminant in your sediment might be a hundred times lower. Just by an order of magnitude, you can do what I call the bloody obvious test and say “well this is a very, very low level of a contaminant of concern. It’s very unlikely to cause an effect.”

Or probably the best way to use these is to use them to help interpret the bioassay results. So sometimes you’ll hear some of my colleagues talk about different lines of evidence. So if we have bioassay data and sediment quality guideline data, we can use those two together to help improve our confidence or increase our confidence about an assessment - a foreign assessment.

Okay. The next part of this is the - if we move past the stream level or essentially we move right into the affect space test - we use what are called benthic toxicity bioassays. And this is again - this effects based test where we let the organisms tell us if the sediment is toxic - if the contaminants in the sediment are toxic.

And there’s very standardized methods that have been developed by the EPA, and there’s also ASTM protocols. The durations are generally like ten to 28 days. There’s a 10-day acute bioassay and then the 28-day chronic bioassay. And the example here that I have - this is supposed to be a beaker, this little box - and how these are designed is you place some sediment in the bottom of the beaker overlying water. And the we let that equilibrate for a short amount of time, place these organisms - and these are little amphipods - that we place into the sediment, allow them to burrow into the sediment for a certain amount of time - either the ten or 28 days. And then at the end we remove the organisms from the sediment, determine how many have survived, have they grown or have they not grown, or sometimes we’ll evaluate reproduction to determine are there any effects associated with these sediments?

And so one of the important points here is that we use a comparison approach where we compare the dredge material to a reference - a sediment - and this reference sediment is often identified in advance. And it's supposed to be a relatively uncontaminated and represent the sediments that are present at your placement site.

There's also a control sediment that is used. And the control sediment - which should not be confused with the reference - is essentially a laboratory control. So if - and that's just to show that your organisms are happy - that they are healthy and they are doing well in this bioassay. A lot of times the control is one that is always used. It's the same sediment that is always used by the testing lab. Many times it's one that they can collect locally.

And so we compare the dredged material and the reference to each other to look at the magnitude. And so if we see for example mortality in the dredged material is 10% greater than the reference - and we also look at a statistical difference from the reference.

So the next thing I want to show you - and hopefully your screen has turned somewhat black now. For those of you that may have not ever had a chance to see a bioassay in a lab, last week I went out to our laboratory and they let me in. And I took a couple of little videos. And I wanted to just show you how a bioassay - when it's set up - actually looks. And so I'll let the little video roll for the first time and then I'll stop it again. And hopefully it's not making everybody dizzy. I'm hoping this is working for everyone.

Julie Marcy: Yes, It's running (Jeff).

Dr. Jeff Steevens: Good. Good.

It's a little jumpy here on my computer. Is it jumpy on everybody else's screen too?

Dr. Jeff Steevens: Kind of - okay.

Well, that's technology for you.

Okay. Ooh - that is jumpy. Okay. So let me run this. And I'm going to pause it for a couple of seconds just to point out a couple of things. I'm going to pause it here for just a second.

So what you see here are a collection of beakers that are present in this chamber. And so often how the bioassay labs run these tests is the chambers have a water bath, and that's to maintain a certain kind of temperature. Then you see these rods that are coming - these little tubes that are coming across the top - is those are, those provide the renewal water for the bioassay. Inside you'll see the beakers and those are - those contain the sediments and they represent a replicate. You see that there's lots of colors and different numbers. And the reason for that is that all of these beakers are all randomized, because you don't want to bias the evaluation process.

Okay. I'm going to let it run just a little bit further to where the hand comes out and grabs the beaker. I think it's a pretty good view right here. Okay. So this is one of the test chambers and this represents a replicate. You can see that there's - this is a 300 milliliter beaker - there's about 100 milliliters of sediment in the bottom. In this case this is Jacob Stanley's hand. And Jacob's family's hand is getting ready to add ten *Hyalella azteca* to this beaker. It has a little more than 125 milliliters of water in it - overlying water. And that's the chamber where these organisms will reside for the next ten days.

If I move forward just a little bit - there we go - you can see that there's a little hole in the side. And that's for the overlying water to run out of the beaker during the bioassay, so that you don't have to disturb the surface of the sediment which is where these little organisms will spend most of their time, just right up at the surface of these sediments. Okay?

Jacob is adding these organisms to this beaker. They'll swim out. It's running a little better than last time.

The next pathway or area where this is exposure that needs to be assessed is through the bioaccumulation. And within Tier 2 we do have some screening methodologies that are available to assess bioaccumulation. And we use what's called TBP - and that's thermodynamically based bioaccumulation potential. Sounds really fancy, but it's essentially just a way to evaluate the partitioning of the chemical in the sediment to the tissues of the organism. And it's based on the properties of the chemical that we can predict this concentration - so as it transitions.

And so there's essentially three numbers that we're most interested in - one which is the concentration in the sediment. So we know that. We've measured that. And then we go to the BSAF database - this is the biota-sediment accumulation factor database, and that's our multiplier. And it's specific to the organism and the containment, and it's used to evaluate the partitioning from the sediment based on the organic carbon that's present in the sediment to the organism, and the percent L is the percent lipid.

So this works for hydrophobic compounds - such as PCBs and PAHs or oil - because they partitioned into the lipids. And the benefit of this is we can fairly accurately estimate the concentration of the chemicals in the tissues of the organism. Generally we don't use this for definitive bioaccumulation assessment, but it helps us understand what do we need to be evaluating in the bioaccumulation test or what do we not need to evaluate in the bioaccumulation test? The reason that's valuable is the bioaccumulation test and the chemical analysis can get to be very expensive. So this can help you manage some of those costs.

So the Tier 3 component of this is to -- and this is more often what we use in a dredge material evaluation -- is to use a bioaccumulation bioassay to measure - that is directly - the amount of chemical that will accumulate in the tissues of these organisms. And similar to the toxicity bioassay, again this is our beaker and we have the sediment and pest organisms and the overlying water. In this case we used worms. There's standardized protocols. Generally we run these for 28 days. We use different organisms. The organisms we use - we like to use very tolerant species that are tolerant of the chemicals of concern so that they - when we put them in there they don't just die right away. We want to have the tissue at the end of the bioassay. At the end of the bioassay we evaluate the accumulation of the chemical of interest in the organism as the end point. So we remove these critters from the sediment, send them to the chemistry lab where they homogenize them and analyze them, and get the concentration of the chemical in their tissues.

Similar to the toxicity bioassay, we compare the dredge material to a reference sediment. Or in some cases we use background concentrations. And that data is used - we can either use the statistical comparison or if - sometimes we'll do it more quantitatively where we evaluate the potential for the contaminants to move into the food web and possibly cause adverse effects further on up the food chain, such as the fish, birds, wildlife and people as I had mentioned before.

And just to show you another video - and I'm hoping this is going to work - this is some work that one of my colleagues, Dr. (Gila Tufo) is doing in the lab. I took this video last week as well. This is just a quick video of some macoma that are a part of a bioaccumulation study. And I just want to point out a couple of things here.

So one thing I want to point out here is - this is the chamber, and oftentimes these chambers are much larger. And the reason that we use larger chambers - in your planning oftentimes you have to include a larger amount of volume of sediment for bioaccumulation bioassays. This is a two liter beaker. It contains about a liter of sediment in the bottom. And the reason you need to have a larger amount of sediment is you need to have enough material for the organisms to burrow, to consume, to feed on the sediment so that they have an opportunity to accumulate the contaminants without depleting the contaminants in that sediment.

Also, the organisms that we used for the bioaccumulation bioassay - as you can see further over here - this is actually a siphon from - let's move past this beaker. You can see here this is kind of a cross section. In this beaker we have macoma. This is actually one of their little siphons reaching up to the top. And so you can see the size of the organisms is much larger than they are for toxicity testing. And the reason for that is so that you can reach the detection limits that are required by the chemists. They'll want lots of tissue. In fact oftentimes they want grams of tissue to be able to do their analysis and meet all their QA/QC.

Julie Marcy: (Jeff) this is (Julie). You had a couple more questions come in. The first one is - do you recommend use of composited soil samples for the tests? That's the first question.

Dr. Jeff Steevens: Yes, that's kind of a loaded question. Sometimes we do. Compositing is definitely beneficial. It depends on the size of your site. It helps get - it's kind of like physical averaging of your site. So - but it reduces some of the costs associated with your evaluation. So there are instances where compositing is very valuable for your evaluation.

Julie Marcy: And another question that came in - when you're doing your analysis, why would you typically go straight to Tier 3?

Dr. Jeff Steevens: That's kind of one of the subtleties of the evaluation process. Within the Clean Water Act we're given a lot of flexibility for the evaluations. So there's opportunities to use some of the screening procedures. The current agreements, or maybe disagreements, between the EPA and the Corpss in some examples for the ocean testing, is that the position is that bioassays are always required for new evaluations. We don't always agree on that. But for most ocean evaluations if you don't have an exclusion, that you immediately move directly into the Tier 3 bioassays.

Julie Marcy: Thank you. And just to give you a time check (Jeff), we have about 12 minutes remaining.

Dr. Jeff Steevens: Okay. So this is my last slide here. So that's a great segue - thank you. I just want to highlight - although I've discussed a lot about the national guidance documents - that a lot of the progress on the scientific community and the advances we've made has really been captured by the regional guidance documents. And the region specific guidance is very valuable because it's often developed jointly between the EPA and the Corps of Engineers. It outlines a lot of the process that's required. In some cases examples of project plans, QUAPS - quality assurance project plans - are included in the documents. So the process is really laid out there (unintelligible).

They also include reference locations, what bioassays should be used, for example which organisms. So they identify what's the preferred organism for bioassay - there's also regional contaminants of concern. There's lists that have been jointly developed, target detection levels which are agreed upon in advance. As I mentioned, they're established for most of the EPA regions.

And I have a couple of examples, and we call them different things. The example I have here is from Region 6. This is a Regional Implementation Agreement. Region 4 has a Regional Implementation Manual. Oops - I got that actually backwards down here. The Great Lakes - they have what they call a Dredge Material Guidance. Region 10 has a guidance document as part of the Dredge Material Management Plan or Program.

So these are all a lot of the regional guidance documents which - in your region or your area, district - you really need to make sure that you seek those out and follow those because they reflect a lot of the local arrangements and some of the better science.

So with that, I think we've got - like you said I think we've got about ten minutes or so for some questions. So feel free to ask any questions.

Julie Marcy: Okay. And there's another one that's come in on chat. Does the Clean Water Act or the MPRSA specify when the sites are to be tested?

Dr. Jeff Steevens: No. Well, sort of. I guess I'm not completely clear on that question. There - one of the agreements on MPRSA is that the evaluation has to occur - the bioassays have to occur for the - for any new work. And that's something that maybe might require some future regulation modification. Under the Clean Water Act we have - as I mentioned before, there's a lot more flexibility and we can make decisions within the Tier 1 evaluation. And so I'd say there's more flexibility on the Clean Water Act that says you don't have to always move into testing. So testing isn't always required, but there's definitely a lot more flexibility on Clean Water Act.

Julie Marcy: Okay. And another one from chat - is there guidance to figure out how many replicates one must use to get a statistically sound answer for the tests?

Dr. Jeff Steevens: Yes. It depends if you talk to a practitioner or a statistician - kind of a joke. But there is some sampling guidance that is available on the (Dots) Web site. And that's something that the EPA has developed. And there's nothing that's prescriptive. And the reason for that is the diversity of the sites which we encounter for our dredging projects requires a lot of best professional judgment.

If you have a fairly homogenous site, you don't need a lot of management units or samples to be collected. I know in some of the regions - and I'll just use this example and I'll wrap up with this question. Like up in Region 10 they do provide some guidance with respect to the size of the project. So say for every10,000 cubic yards, they recommend a sample to be taken. But you go to different parts of the country where, you know, projects are much larger, then that may not apply. So it really depends. There's not a real specific answer for that.

Julie Marcy: Okay. Thank you. And we'll just open it up at this time. You're welcome to ask questions - either verbally or using the chat - as you prefer. (Jeff)'s covered a lot of territory, so if there's something you need a little more info on, ask away.

Man: Yes, just general a question - are the slides available? May we obtain a copy of this presentation?

Julie Marcy: Yes. There's a PDF of the slides posted on the (DOTS) Web site.

Man: And that is? I guess I don't have that.

Julie Marcy: We'll provide it to you.

Man: Okay. Thank you.

(Tom Fredette): Hey (Jeff) this is (Tom Fredette).

Dr. Jeff Steevens: Hey (Tom).

(Tom Fredette): Hey. When you were talking about the four hour mixing rule, I know that's specific to MPRSA and I don't recall and I don't think that it's relevant to the Clean Water Act. But I don't recall. I don't know if you double checked that or not.

Dr. Jeff Steevens: You know, I don't know that one off the top of my head. I know the state specifies the size of the zone, but I don't know if they influence the duration of the mixing. Does anybody else on the phone have an answer to that one?

(Laura Inouye): (Laura Inouye) with the State of Washington. In this state you actually - it's at the edge of the mixing zone there's an acute four hour or acute affects is a four hour averaging. For chronic it's anywhere from four hours to four days, depending on your chemical. And what happens inside that mixing zone is actually - that's not what's being measured. It's at that point of compliance which is at that edge of the mixing zone.

Dr. Jeff Steevens: The edge, yes.

Julie Marcy: Okay, (Jeff) we've had another one from chat. How do these tests and evaluations apply to inland waterways such as the Mississippi River?

Dr. Jeff Steevens: So the evaluations do apply. You can use them for the Mississippi River. Although I think, you know, as you're moving through the process, a lot of the sediments on the Mississippi River - you would have an opportunity for an exclusion, because a lot of times we're doing side casting or using a dustpan dredge. And so we're just kind of moving the sediments within the river. And so oftentimes you don't need to do a tier III evaluation using bioassays

Now with that being said, I do know of some examples, such as like the Port of Memphis, where they were doing some dredging and wanted to place some sediments from the Port to the river. And there they needed to do some bioassay testing for the purposes of confirming that they weren't going to cause any effects there. So they could definitely apply there.

Julie Marcy: And another question - has there ever been a Corps project where the guidance was followed and there was still a problem with contaminants after the dredge was disposed of - the dredge material was disposed of?

Dr. Jeff Steevens: Still a problem with contaminants - so, yes. There have been some examples of that and I'll do - I don't think we encounter that as much. And there's two places where that can occur. One is where the dredging occurs, and so one of the concerns we have there is with the exposed surface. So after you dredge, what does the new exposed surface look like? And that's kind of a contentious topic. It's a difficult question to answer.

The other thing is some of the historical dredging that we've done - we have some disposal sites, or some ocean disposal sites that may have some previous contamination. And not to mention any names, New York District has a problem site that they're managing in a special way to cap that material and reduce exposure of organisms.

Julie Marcy: Okay. Thank you. I think that's all I've had coming in on chat so far. Are there any other questions that folks have?

Dr. Jeff Steevens: Any other comments from any of the experts on the phone?

(Mary Richards): This is Mary from Savannah District. I've got a question. We've had problems in the past - one year particularly that we had a 103 (performa) conducted in Brunswick. And they used an organism that we don't normally have in the channel here. But we were told it's based on availability and we were kind of forced to use that, you know. Now we're stuck with (unintelligible) restrictions until we do another test event.

Dr. Jeff Steevens: Yes, that's kind of - that goes back to that conceptual model piece I was talking about - to try to use organisms that are relevant to your system - although the bioassays are not perfect. Sometimes you have to field collect organisms, and if they are not available and they're not cultured in the laboratory to try to make progress, sometimes with our evaluations we use organisms that are cultured but might not be as relevant to the site.

(Mary Richards): Right.

Dr. Jeff Steevens: And that sounds like that's the situation that you've run into. That's unfortunate that that happened. Sometimes we have to use organisms that can deal with the sediment grain size or other confounding factors. Like with some of the amphipods there are some organisms that can handle - tolerate different grain size that other amphipods cannot. So we end up switching organisms. That's unfortunate. I'd be interested in talking with you further about that problem, and maybe come up with a different solution.

(Mary Richards): Thank you.

Julie Marcy: Any other questions? And if you'll notice (Cynthia Banks) was kind enough to put the (DOTS) Web site URL in chat for us. If your chat box isn't showing, at the top of your screen you should have a little green box that says "visiting (Jeff Stevens)" and you can click on the chat tab there so that you can see the URL.

Any other questions before we conclude for today?

All right. Well thank you so much (Jeff) for sharing your knowledge with us, and thank you to everyone for participating today. We covered a lot of great information and some good questions as follow-up. Be watching for upcoming notices on additional (DOTS) webinars this summer from (Cynthia Banks) at ERDC and I hope everyone has a great afternoon.

This concludes our session.

END